

him rowing a boat upon Stowe Lake. Following the presentation of these pictures in court, the plaintiff was convicted of perjury and sentenced to jail.

This is just one of many cases in which a plaintiff has completely deceived the examining physicians. After nearly twenty years of experience in the trial of negligence cases, I am coming more and more to the opinion that an astonishing number of permanent injuries, if studied with a motion-picture camera before trial, or if followed and studied after trial, would reveal just what this motion-picture operator fortunately found before it was too late.

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PHILIP STEPHENS, M.D. (1136 West Sixth Street, Los Angeles).—I think the best lesson to be learned by this most excellent paper of Doctor Weber's is a simple fundamental fact, namely, that when on the witness stand we should state facts. In other words, tell the simple unvarnished truth when we can, and qualify our statements if it is necessary to do so, and not allow our opinions to be swayed by either side in the case; to never, by any word or statement, give any judge or jury the faintest reason to suspect that we are what is known as a paid advocate, a thought which is always in the mind of, at least, the jurors, largely due to the fact that we are summoned by either one side or the other in the case; that it is neither right nor honest to favor, or show a tendency to favor, plaintiff or defendant, whether a private individual or corporation, rich or poor, by word or deed. In short, justice should be blind, but the law looks to us to properly evaluate the degree of disability and we should attempt to do it honestly and with favor to none.

A great deal of his paper could have been gotten from any medical jurisprudence, but the advice relative to its application and practical use is, without question, invaluable, and we hope that much of the information contained therein will be presented again and again so that all doctors may be sufficiently informed, and act so that at least some of the odium which we have borne in the past, in the matter of medical testimony, may be forever removed. We are glad to note the sincere effort on the part of the legal fraternity and Bar Association to cooperate with us, and to be working with us toward that end.

THE MEDICAL AND SURGICAL ORGANIZATION AT BOULDER DAM*

By RICHARD O. SCHOFIELD, M. D.
Boulder City, Nevada

DISCUSSION by R. A. Bowdle, M.D., East Ely, Nevada; R. F. Palmer, M.D., Phoenix, Arizona; J. C. Geiger, M.D. San Francisco.

THE physical organization of construction programs heretofore has seldom afforded an opportunity for the coordination and the complete centralization of the various phases of work such as come under the head of Industrial Medicine and Surgery, as has been the case at Boulder Dam.

An attempt is here being made to enumerate and evaluate the subdivisions of industrial work, particularly in regard to public health problems, water supply, sewage disposal, school problems, industrial hygiene and safety, first aid, surgical repair, compensation insurance, hospital management, and medical legal aspects, as they have presented themselves on the project which is being constructed by the Six Companies Inc.

CIVIC SET-UP AT BOULDER CITY

Boulder City was established and built by the Department of Interior through the Bureau of Reclamation in 1931 on part of what has been designated as the Boulder Canyon Project Reservation, which is located in the southern-most portion of Nevada. It is situated twenty-four miles from Las Vegas, Nevada, at an elevation of 2,500 feet, and is eight miles from the site of the Boulder Dam which is being constructed in the Black Canyon of the Colorado River. It is connected with Las Vegas by a paved highway and a branch of the Union Pacific Railroad. Electricity is brought to the city from Riverside, California, 225 miles distant, by a direct high-voltage transmission line. The city is governed by a city manager, who is employed by the Secretary of the Interior. Policing of the city and the entire reservation is in the hands of Federal officers. Originally the plans called for a city of about 3,500 people; the present population is more than six thousand. Upon completion of the construction work, only a small portion of the city will remain with an estimated population then of from five to eight hundred people. Permanent structures include a modern, air-cooled hotel and a theater, some commercial houses, school, hospital, Bureau of Reclamation office and dormitory, municipal buildings, and a few residences.

The Bureau of Reclamation is the designer of the Dam, with Walker R. Young in charge as construction engineer. The Six Companies Inc. are the builders of the Dam, with Frank T. Crowe in charge as superintendent of construction. The contract price for the completion of this portion of the Boulder Dam project is \$49,000,000. The Babcock and Wilcox Company hold the contract of \$11,000,000 for the steel piping used in the tunnel linings.

PUBLIC HEALTH ORGANIZATION

As health officer it is necessary to correlate various requirements of federal, state, and city regulations. Centralization gives a smooth, efficient organization, which at all times has received the unqualified support of all three agencies.

Garbage removal is effected through its collection in the early hours of the morning in properly equipped and, where necessary, covered vehicles, and it is disposed of by incineration and use as food for hogs in near-by communities.

Food handlers employed in the stores, restaurants, fountains, and commissary are examined as to the presence of skin disease and venereal infections. Physical cleanliness and proper sterilization of equipment used in these places of public service are demanded.

The graded school has an attendance of about seven hundred pupils, and approximately nine hundred children of the preschool age live in the city. A full-time school nurse is employed whose activities are directed toward the care of the general health of the school child in regard to supplementary feedings for the undernourished, inspection of the children for possible acute infections, eye trouble, and static deformities. Her

*Presented at the thirty-first annual meeting of the Nevada State Medical Association at Reno, Nevada, September 22, 1934.

services are also extended into the various homes when necessary. One hundred and sixty students attend the high school in Las Vegas.

Contagious diseases are controlled through effective measures of isolation in the home and the removal of patients to isolation premises. The usual exanthemata are found, but only in the case of measles have we encountered an epidemic. There have been no cases of infantile paralysis. Perhaps a splendid example of the thorough co-operation that is shown in the city was afforded some fifteen months ago when three cases of smallpox were found in one day, and on the next day four more cases appeared. A careful check showed that all of these occurred in one and the same dormitory which was operated by Six Companies Inc. One hundred and seventy-seven occupants of this dormitory were men who worked during the various three shifts of employment of the day. This dormitory building was scrubbed with lysol and water, and this scrubbing included the floors, the walls, and the windows of every sleeping room, closet, hallway, and toilet in the building. Each mattress and pillow was carried to the outside and sunned for two hours, and then turned and sunned on the other side for two hours, and then replaced in the cleaned rooms. All washable linen and blankets were removed and a complete fresh supply of these articles was furnished to each room. A fresh supply of vaccine was obtained by air express, and all of these men were inspected and vaccinated. The above procedures were carried out in a period of fourteen hours, and the usual rest of any employee who lived in this dormitory was not disturbed. The whole program was completed within forty-eight hours from the time of the appearance of the first case of smallpox.

WATER SUPPLY OF BOULDER CITY

The water supply of Boulder City is obtained from the Colorado River at a point about three-fourths of a mile below the Dam site. The entire system, which includes the collection, pumping, filtration, and distribution, and which cost in excess of \$750,000, was built by the United States Bureau of Reclamation. The plant is designed to treat two million gallons daily with what is known as the "excess lime and soda ash treatment," and was adopted upon the recommendation of their consulting engineer, Mr. Burton Lowther. The operation of the plant is under the direction of D. M. Forester, who is establishing a record in the field of practical water chemistry and bacteriology. The average daily pumping is one million gallons. The Colorado River is not only a rapid stream, but it is a very turbulent and muddy river, which carries an average of 6,000 P. P. M. of suspended solids and 1,700 P. P. M. of dissolved solids. The preponderant mineral contents show the presence of Na 118 P. P. M.; Ca 93 P. P. M.; and Mg 33 P. P. M. The water is very hard, and the hardness as CaCO_3 averages 367 P. P. M. The fluorin content of the raw water is less than 0.1 P. P. M., and this amount is reduced by half after routine chemical treatment. The allowable fluorin content is considered as 3 P. P. M. The

question of fluorin has been brought up because during the past few months there has been considerable concern expressed over the high fluorin content of the water that is used for drinking purposes in Boulder City. The statement has been made that the teeth of our children are soft and crumbling, and that there is interference with normal dentition. From my own examinations of the children who live here, it is not true that the above defects can be shown to exist in any greater proportion in this community than elsewhere. The operation of the water plant effects the delivery of a potable water supply through presedimentation, aeration, softening, recarbonation, filtration, and chlorinization. Presedimentation for four hours in the intake tanks on the river removes 98 per cent of the suspended solids. The water is then pumped six miles against a static head of 1,900 feet through two pumping stations. At its point of delivery in Boulder City it is aerated, which removes CO_2 and also oxidizes minute organic materials which are present. From here it enters the clarifiers, where is added the lime and soda ash which give a chemical combination to produce flocculency for a sedimentation of the CaCO_3 hardness. The excess of these chemicals which are added leaves the water very caustic, and this causticity is later reduced by passing through CO_2 for half an hour. Sand filters now remove the fine sediment, and the water is then chlorinated upon its delivery into the distributing mains. This treatment requires the daily use of two thousand five hundred pounds of lime, one thousand nine hundred pounds of soda ash, and five and one-half pounds of chlorin. The filter plant sludge which is thereby removed consists mostly of calcium carbonate, and averages in amount twenty cubic yards daily. Daily presumptive tests are run on the tap water, and each test is carried on to forty-eight-hour completion on agar plates. The B. coli index of the raw river water is 3.18. The U. S. P. H. standard allows a 0.01, while the average analysis of delivered potable water is 0.005, indicating a wide margin of safety.

SEWAGE

The sewage plant is of the split sludge digestion type, being built and operated by the United States Bureau of Reclamation. The plant cost in excess of \$50,000, and is designed to care for 0.5 M. G. D. of sewage. The incoming raw sewage is strained through trash bars which remove the coarser particles, and it is then passed into clarifiers, where solids are removed by sedimentation. Ninety-eight per cent of the contents are run off as a supernatant fluid and piped for some two miles, where it flows out over the desert and is bacteriologically free at this point. The sedimented solutions are then pumped into the digestion tank, which is fitted with a gas-tight dome. Digestants in the order of their occurrence consist of the protein group followed by the denitrifiers, the fat-splitting and the cellulose digestors, which produce the end-products of methane and H_2S , some CO_2 , and sterile solids. About ninety cubic feet are digested daily with an output of

four and one-half cubic feet of sludge. The methane gas which has collected in the dome of the digestion tank is used to heat water that is circulated through coils that keep the contained temperature of the digestion tank at 90 degrees Fahrenheit, allowing digestion to proceed at an optimum rate. Surplus methane is burned in an outside incinerator, to which is added the coarser particles removed from the trash bar. Sewage plant sludge is bacteriologically sterile and is used for fertilizer on lawns at Boulder City.

MILK

The standards set by the state laws of Nevada for the production, analysis, and distribution of milk are in effect on the Reservation. Private dairies supply the residents of Boulder City. The commissary of Six Companies Inc. is supplied by milk from their own dairy, obtained from 125 tuberculin-tested cows. This dairy is located about one hundred miles from Boulder City, and is an entirely modern plant in every way. The milk is precooled and refrigerated, transported to Boulder City, and served to the men as raw milk without any pasteurization. To be able to do this, in the face of excessive summer temperatures of more than 115 degrees, obviously requires meticulous care of the milk at all times. It is interesting to note that no water- or milk-borne diseases have been encountered in Boulder City, with the exception of one case of typhoid fever, which occurred in a young girl in whom the source of infection was definitely traced to the use of home-made butter brought to this family from a ranch in the State of Idaho.

Some months ago when the amebiasis epidemic was first made known in Chicago, it seemed very probable that we might expect the occurrence of an outbreak in our locality because of the constant turnover in employees who are accepted from every portion of the country. Our precautions at this time were that no food handler was employed who gave a history of having worked in the vicinity of Chicago for a period of six months prior to the time of his application for employment here on this project. To date we have had no cases of amebiasis.

INDUSTRIAL HYGIENE AND SAFETY

The dormitory quarters which are furnished to the single men include single furnished rooms with a small porch, these rooms being cooled by refrigerated air in the summer, and heated with hot air in the cooler months. The original plans for operation of the housing problem here at Boulder City did not include such measures as delousing and detention facilities previous to permanent dormitory residence. Approximately sixteen hundred men are cared for in the dormitories with accommodations that range from one hundred to two hundred men each. Regular inspections are made of these premises, and it has been my pleasure to find that they are always clean, particularly as regards washrooms and toilets. Strong efforts are made to see that the men wear slippers or some form of foot covering at all times when in the dormitories. Several cases of athletes' foot have

occurred, but at no time has it ever assumed the semblance of an epidemic. The bedbug pest is cared for by cyanid fumigation, and complaints from this source of annoyance are rarely made. Such fumigation is carried out under direct supervision and in accordance with the State regulations. The menace of flies is not met with in this desert community to any great extent, but no doubt this is in a great measure controlled by the prevention of the existence of breeding places.

SAFETY

Since the beginning of the project particular attention has been paid as to the safety of employees, primarily in regard to the prevention of accumulative powder smoke and bad air conditions that might be present in the extensive tunnel work. Positive ventilation systems were installed and qualitative determinations of air conditions were carried out by experienced safety engineers throughout the entire construction period. Dust masks and inhalators were worn by workmen in the occupations where the same were required. Protective helmets, not unlike those used in the late war, but which are constructed of a very resistant *papier mâché* material are supplied to all workmen. Actual concrete workers wear rubber boots, both for their own convenience and for the prevention of disabilities resulting from working in the concrete. Protective devices are always used where possible on all types of machinery. I believe it is quite definitely shown that the best work in safety prevention is done by the foreman, and he can be relied upon to handle the situations arising in his particular sphere of the work perhaps as well or better than a safety inspector.

EMPLOYMENT REGULATIONS

Employment on the project is possible only through the facilities of the Federal and State Employment Bureau, which is located in Las Vegas. To date there have been some 19,000 men examined, with 850 rejections. The physical infirmities for rejections in the order of the occurrence are: cardiac and vascular disease, 300; hernia, 200; defective vision and hearing, 180; and the balance, due to manual deficiencies and other causes. Geographical distribution shows that California leads and is closely followed by Nevada in supplying the greatest number of men accepted for employment, being 4,500 to each State. Utah, Washington, Idaho, Texas, Oklahoma, and Missouri follow in the order named, with the remainder being divided among all of the other States. About 1,600 ex-service men are now working, and the proportion of married to single men is five to four. The average age of employment during the summer months is 31.6 years, and in the cooler months the average is raised to 34.5 years. At this time more than 4,100 men are employed by Six Companies, Inc., 300 by the Government, 220 by Anderson Brothers' Supply Company, 250 by the Babcock and Wilcox Company, and 150 by the Boulder City Company. The maximum employment at the time the project was begun was considered to be about 2,200 men, and living accommodations available for this number,

both as to dormitories and as to houses, were based upon this figure. With the number of employees doubled, it has been necessary for the men not only to live in Boulder City, but great numbers live in Las Vegas and in small mushroom communities near by. The Six Companies Inc. have about seven hundred two-, three-, and four-room cottages available to married men, which are rented on a scale according to the type of house occupied. Single men live in the dormitories and board at the mess hall, which is capable of seating 1,200 men at one time and is operated by the Anderson Brothers' Supply Company. Sufficient diversity of foods is afforded, so that a man who may be on a restricted diet, as in the case of a nephritic or a diabetic, can obtain a necessary choice of food. They are charged \$1.65 per day, which includes board, room, and five cents per day hospital fee. The lowest wage paid is \$4 per day for eight hours' work, and the average wage is \$5.31 per day.

CARE OF INDUSTRIALLY SICK AND INJURED

Compensation insurance is carried in the State funds of Arizona and Nevada. At the present time the experience record on the project determines the rate of premium that is paid. Constant endeavors are made to provide maximum efficiency in safety, and this, together with competent medical and surgical care, materially reduces the rate of premium on these compensation policies. Medical and surgical care for the injured man is furnished by the Six Companies Inc. through the facilities of their hospital department. Two completely equipped first-aid stations, in the hands of three competent and experienced first-aid men, are operated at the site of construction, one station being located in the Canyon and the other situated on the brink of the Canyon wall. An average of more than one hundred cases daily report for all classes of treatment at these stations. Ambulance service is in effect direct from the stations to the hospital, requiring an elapsed time of about twenty minutes to transport the injured between these points. The hospital is a permanent structure costing in excess of \$90,000, is located in Boulder City, and has a capacity of sixty beds with an average occupancy of thirty-one beds. It is fully equipped with standard hospital appliances, which include stationary and portable x-ray and fluoroscopic units, diathermy, infra-red and mercury quartz lamps. There are facilities for complete blood and urine work, and a pharmacy of sufficient size to care for our needs. Five doctors comprise the staff, all of whom are graduates of Class A medical schools, and who have had postgraduate and residence work. Only registered graduates are employed on the nursing staff, which averages eight in number. A competent radiographer is in charge of the x-ray department in conjunction with the administration of the pharmacy. The hospital management is effected with the aid of an auditor, who devotes his entire time to this work, and an office secretary, who has charge of records and files. Four orderlies and a cook comprise the remainder of the staff. A fee of \$1.50 per month is paid by each employee and the sum

of \$1 per month is paid by the Six Companies, making a total of \$2.50 per employee that is received by the hospital fund. This provides a working fund for medical and surgical care rendered to the employees on the project. Our average meal cost is thirty-eight cents. The average cost per nursing day is \$5.15, and the cost per day per patient in the hospital is \$9.10.

Up to September 1, 1934, there have been expended twenty-five and one-half million man hours of work in the construction of the Boulder Dam, which means that it would take one man eight thousand years to carry out this work alone. Work is carried on twenty-four hours each day, seven days a week, and approximately 1,200 men are employed in each of the three eight-hour shifts. With the employment of about five thousand workmen on the project and in Boulder City, we find that the occupations include practically every form of work that is done by man. We might mention that here we find miners, muckers, carpenters, plumbers, electricians, engineers, a complete coterie of railroad employees, clerical force, commissary attendants, truck drivers, riggers, mechanics, chemists, steel workers, cement workers, and all forms of general labor. From the diversity of these occupations the nature and type of injury received covers practically every field known. Over 4,300 reportable industrial injuries have occurred. There is an average of four to fourteen accidents each day, which require the attendance of a doctor. Hospital entries are from one to seven per day. Industrial deaths to date since the project started number seventy-four; non-industrial deaths among the workmen are seventy-two in number. Patients requiring treatment in the outpatient department average two hundred per day, with a maximum of three hundred and fifteen having been cared for during a period of twenty-four hours. An average of thirty-three x-rays are taken daily. In the past eighteen months we have cared for nine hundred and nineteen fractures, and nineteen major dislocations. For the most part these fractures were reduced under two per cent novocain introduced locally into the site of fracture, and in some instances, of course, no anesthetic was necessary. For the most serious cases, we have administered ninety-two spinal and fifteen ethyl chlorid, seven ether, and two brachial anesthetics. We have had no severe current nor after-results following the spinal anesthetics. In fact, it is a rare thing to have even a mild reaction. Perhaps the outstanding fracture figures are the relatively few femur fractures seen, and the high number of os calcis (32), astragalus (25), tarsal scaphoid (20), and vertebral body fractures (32). About 15 per cent of these fractures are compounded, and in many of these instances direct reduction of fragments was possible at the time of care for the compounded injury. The pin method, as advocated by Boehler for the reduction of fractures, is always used whenever the same is possible. Only six elective open reductions have been done. We make use of the direct application of a non-padded cast for immobilization. Twenty-one herniae have been repaired surgically. Thirty-six cases of pneumonia

have been treated, with five resultant deaths. Heat prostration has continually been an existing menace on this project, but by educational, preventive measures, and by the institution of prompt therapeutic measures, both of which involve the adequate use of normal saline and water, we have been able to reduce the number of cases that do occur, and during the past three years there has not followed a death from this cause.

I believe that the very strict management and care of compounded soft tissue wounds has shown very definite results in the very small number of infections that occur, and in minimizing the amount of disabilities that ensue. When a patient presents himself for treatment, the clothing is removed from the immediate area and the surrounding skin is cleansed with benzine or with green soap and water, and dried with ether and then painted with tincture of iodine. A sterile dressing is then laid on the cleansed area and the wound is cared for by scrubbing it out with green soap and water, followed by lavage with sterile water or saline. No iodine or other caustic is used within the wound itself. The tissues are carefully debrided, and devitalized portions are cleaned out and cut away. In the deeper wounds which involve tendons, primary tendon sutures are always done. The skin and subcutaneous tissues are sharply excised and wounds are closed tightly. Compounded injuries involving the skull, particularly the sinus areas, may be drained for twenty-four hours. Lacerating wounds extending through all structures of the cheeks or lips are always closed tightly and, likewise, the wounds of the eyes and orbital area.

MEDICO-LEGAL PROBLEMS

A very important part of industrial medicine at Boulder City is concerned with medico-legal cases. Because of the very complete coverage of all kinds of labor involvement on the project, innumerable opportunities are offered for the presenting of complaints that may establish legal basis for suits against the employer. These usually take on the aspect of impaired health and disabilities incurred that cannot be connected with the compensation laws of either Nevada or Arizona. The best defense for such suits is in very complete detailed records of examination, first-aid visits, medications, treatments, hospital entries, and special reports, as indicated in blood chemistry and perhaps along neurological lines. The contained detail from these sources must then be analyzed and correlated, and presented in proper form for use by the legal staff. To date only one major suit has been tried, in which there was requested \$76,000 for disabilities resulting from what was claimed to be the effects from exposure to existing tunnel conditions, the plaintiff having been employed as a truck driver during the course of construction of the larger tunnels.

SUMMARY

Complete records are being kept in all departments that will ultimately be available for use in obtaining further definite statistical information in all scopes of industrial medicine and surgery as

has been herein outlined, particularly in regard to the effects of treatment and results that may be expected in terms of percentage of loss of function of a disabled man, or in the efficiency of operation of any unit of the organization.

Six Companies Hospital.

DISCUSSION

R. A. BOWDLE, M. D. (Chief Surgeon, Nevada Consolidated Copper Corporation, East Ely, Nevada).—Doctor Schofield is to be complimented on his presentation of a most interesting paper. Certainly, it has covered the situation at Boulder Dam most completely.

It has been my pleasure to visit Doctor Schofield and see the excellent organization of which he is the head. The hospital is modern and very well equipped. The surgical work which is being done by himself and his staff is excellent. The employees of the Six Companies, Inc., are most fortunate in having him head their medical organization.

To those of us who have been connected with large industries over a period of years, it is a great satisfaction to see the development which has taken place in industrial medicine. It is a far cry from the days of the old "contract practice" to the present efficient and well-trained medical department of a large corporation. Certainly, in no branch of medicine does the patient receive more careful or more complete and competent care than from these well-organized medical departments.

The manner in which Doctor Schofield has handled the sanitation is excellent. The experience gained from his care of the heat-prostration cases is most valuable. The results of his observations and treatment along this line will undoubtedly be a guide to other employers in hot climates. It is most interesting to note how well the contagious work has been handled. It is only by paying attention to the sometimes seemingly trivial details that epidemics may be prevented. So far as the traumatic work is concerned, the Six Companies Inc. has been engaged in a most hazardous undertaking. I am surprised that there have not been more fatalities. I would like to pay tribute to the Nevada Industrial Commission for their excellent co-operation in the handling of compensation cases. It is indeed a pleasure to work with a commission that is as fair and just as this one. It is most interesting to note Doctor Schofield's manner of handling his traumatic work. Probably the excellence of his results is largely attributable to the care that the injured man receives and the promptness with which it is given. Three factors are important in this work: time of treatment in relation to injury; the thoroughness of the first treatment; and the careful follow-up, involving the obnoxious details necessary in the treatment of fracture cases. The work of Boehler has added greatly to the better results obtained in fracture work. Spinal anesthetics in the treatment of fractures, and dislocations of the lower extremities, have made for greater ease and more accurate reduction, thereby improving the end-results. We have used the Roger-Anderson technique and are very well pleased with the results obtained by it.

Relative to the medico-legal aspect of industrial medicine, it may be said that it presents many trying and bothersome angles. The necessity of complete and accurate records is essential if one is to be able to disprove some of the fraudulent claims.

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R. F. PALMER, M. D. (Medical Referee to the Arizona Industrial Commission, Phoenix, Arizona).—On considering the discussion of Doctor Schofield's presentation of the industrial, medical, and surgical organization at Boulder Dam, one is immediately impressed by the immensity of the work and the diversity of problems falling on the shoulders of the chief surgeon; problems perhaps as great and complex as those involved in the construction of the dam itself, and assuredly forming an important integral part in the

successful consummation of this great engineering monument.

As medical referee to the Industrial Commission of Arizona it has been my duty, as well as my pleasure and privilege, to visit the Boulder Dam project at more or less regular intervals, for the purpose of examining and rating workmen injured in the course of employment and coming under the provisions of the Arizona Workmen's Compensation Laws.

My first thoughts in visiting this model city and project in operation, so complete in every detail for the carrying on of a tremendous work with every safeguard and convenience for the health, safety and comfort of the workmen, were those of comparison; contrasting conditions here with conditions present during the construction of the Roosevelt Dam in Arizona, where more than thirty years ago, as chief surgeon on that project, I was confronted with many of the industrial, medical, and surgical problems which are found here at Boulder City, but under vastly different environment and circumstances.

Our Roosevelt "model city" was scattered irregularly over a dusty hillside on the banks of the Salt River, and our buildings (except for the office, blacksmith shop and a few dwellings at headquarters camp constructed of fresh-hewn and uncured Arizona pine) were made up of temporary canvas structures. We had no railroads to the project, or even paved roads. In fact, we had *no* roads in the *early* days of the work; and there were no automobiles or motor trucks to use on them if such roads had existed. Early transportation was effected by means of horseback and pack animals, with later the Concord stage coaches and twenty-mule jerk-line teams traversing narrow mountain grades. We did have electric power after a time, this being one of the preliminary developments on the project which added much to the comfort and convenience of camp life. Our dormitories were scattered tents in scattered camps, extending for seventy-odd miles along the Salt River and to the pine timbers in the Sierra Ancha Mountains. Our hospital was termed a field hospital and, like the other buildings, was made of canvas stretched over fresh pine boards. We had no x-ray laboratory or other scientific equipment so necessary for the demands of a first-class hospital of today. Our water supply, however, was simple and efficient—a mountain spring, dammed up and piped by gravity to the storage reservoir, where the only chemical treatment required was an occasional dose of copperas to control the excessive reproduction of algae. Nature also provided ample bathing facilities, for adjacent to the main camp were adequate hot springs with a large pool, and for those who preferred cold baths, there was always the river. Although the summer temperature was high, we had no particular difficulty with insulation or sunstroke, because the Salt River at that time carried 2 per cent by volume of sodium chlorid. Garbage was taken care of by hogs and incinerators. Cloudbursts, which were frequent in those days, washed away the empty tin cans at irregular intervals, and sanitary squads with ample supplies of lime kept the various individual and collective latrines in condition to pass inspection. The officers' quarters at Roosevelt were provided with modern toilet equipment. Sewage disposal for this small community was handled by means of a settling and fermentation tank, with an aerobic film-rock filter. This plant was one of the very early septic tanks constructed in the United States, and has continued in successful operation to this day.

In spite of these seeming drawbacks to modern sanitation, there occurred, during the building of the dam, but seven cases of typhoid, some twelve cases of malaria—imported from our neighboring State of the West—an occasional looseness of the bowels not to be considered dysentery, and a few sporadic cases of ordinary contagious diseases.

The chief surgeon on this project visited the various camps on horseback, and for a hospital staff he had one third-year medical student as an assistant, and one ex-army aide trained in the Philippines for an orderly. Emergency operations were performed "as was," and where found. It is needless to say that

the open reduction of fractures was not looked upon with favor, and was avoided in all cases whenever possible.

With this background, and after a lapse of so many years, it is needless to comment further on the tremendous impression made upon me on the occasion of my first visit to Boulder Dam. You will pardon, I am sure, this slight digression from the subject-matter under discussion, for, as stated by Doctor Schofield in his introductory paragraph, "the physical organization of construction programs heretofore has seldom offered an opportunity for the coordination and centralization of the various kinds of work that come under the head of industrial medicine and surgery, as has been done at Boulder Dam." The fact that this opportunity has been so taken advantage of and so thoroughly worked out, is one to be commented upon, but the efficiency with which all problems of public health and industrial hygiene and safety have been carried out and so well detailed in the presentation by Doctor Schofield, leaves but little, if anything, to be added.

My particular interest in the problems presented lies in the medical care and restoration to function of the workmen who, in spite of the careful preparations and innumerable safety measures, have been unavoidably injured. On contacting these individual men, I am first impressed by the fine type of young American manhood which makes up the employees on the project; and especially by their fine mental attitude and morale, and their cooperation with the medical staff in securing the greatest possible functional restoration from their injuries. With a total of more than eighteen thousand men employed on the project since its beginning, and with much of the early work in the Canyon of an extremely hazardous character, it is remarkable that there have been but seventy-four industrial deaths. This certainly speaks well for the safety measures employed.

The volume and diversity of medical and surgical work, with an average of two hundred patients a day in the outpatient department alone, is almost suggestive of a medical center in its opportunities for teaching, and in its value to medical observation and progress. Perhaps, from a surgical standpoint, the fracture work at the Boulder City Hospital will constitute the most valuable contribution on this subject of any fracture clinic of modern times. From the hazardous character of the work and the injuries resulting, many of these fractures are of the most serious and complicated types. Fifteen per cent of them are compounded and oftentimes there are multiple fractures in the same individual. In one case, if my memory serves me correctly, there were twenty-two separate and distinct fractures sustained by one individual in one accident, and it was my privilege to see this man living and making a good functional recovery. The use of local anesthesia in reductions of such a large number of cases is to be noted, as well as the relatively small number of open reductions which have been found necessary.

The anatomical end-results of these severe fracture cases, together with the minimum loss of time and permanent functional loss, will be one of the outstanding features of the Boulder Dam Hospital service when it is compiled and written into medical history.

It has been a pleasure to study this paper and a privilege to discuss it.

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J. C. GEIGER, M.D. (Director of Public Health, San Francisco).—In discussing this paper, opportunity is given to point out the advantages to be had by careful planning prior to the building of a new community. Boulder City might be looked upon as an ideal experiment in establishing a modern urban center.

Once such a community is established, it is then essential for those in charge to provide the necessary protection to public health through the medium of a competent health officer, and thus maintain a high health rating. On the other hand, it is very easy to allow conditions to manifest themselves so as to relegate the town into the category of a community with an average public health record, or even into the class

of those considered to have a poor record. Doctor Schofield's statements on the public health of the city and the excellent standards that he has been able to maintain, as reflected in the condition of the city today, are indicative of the health dividends to be expected from careful planning and proper control. Particular credit is due to those in charge of public health at Boulder City, when we consider the rapid increase in population until, at the present, the community is accommodating approximately double the maximum it was originally intended for. Aside from the usual problems of public health within this community, the health authorities have been confronted with the continual heavy influx of tourists from all parts of the world.

The water supply of this city is of exceptional interest from the standpoint of public health. During a visit to Boulder City I was quite interested in knowing just what was being done to Colorado River water to transform it into a potable supply. Inspection of the filtration plant afforded an occasion to observe the careful methods of treatment employed, and the concise control measures maintained through proper bacteriological and chemical examinations. Doctor Schofield's figures on the flourine content of the water are of exceptional interest and importance. His statements relative to the concern that has been expressed over the high flourine content, and the adverse remarks that have been made pertinent to the condition of the teeth of the children residing in the town, are very timely. As health officer, his observations of school children and contact with the dentists of the city allow him an opportunity to closely observe this phase of public health, and is thus able to be the better judge of the entire subject in his neighborhood.

Sewage disposal is in keeping with modern sanitary engineering and public health practices. The plant is of sufficient capacity to care for the needs of the present population, and is of desirable construction and design.

The milk supply presents itself as a problem of some significance in view of the excess summer temperatures. It is pleasing to note that the supply for the commissary of the Six Companies Inc. is produced on a ranch owned by that corporation, and comes entirely from tuberculin-tested cows. Such an arrangement allows very close supervision in exercising public health control measures over production and distribution of the milk for approximately one-sixth of the entire population. The absence of compulsory proper pasteurization is to be regretted, and could be considered a definite criticism of an otherwise perfect set-up for milk control.

On a project such as Bolder Dam, adequate housing for employees is always a problem of some magnitude. Unfortunately, in altogether too many instances this factor is not properly dealt with and adversely affects the health, moral and working ability of employees. I was particularly impressed with the accommodations for single men in the dormitories, and the desirable houses for married men and families. The buildings were well constructed, and equipped so as to allow maximum comfort for the climatic conditions.

While visiting the project one's attention is drawn to the safety measures in use, and the obedience to safety rules exercised by the workmen. The gigantic undertaking and the speed continually maintained leaves the casual observer with a feeling that employment here is of a very hazardous nature. Closer observation, however, discloses the many safety devices available, and the alertness of the employees to avoid accidents despite the casual manner and ease in which they go about their tasks. The enforcement of safety rules by competent foremen is unquestionably an agreeable and efficient set-up, but the employment of a safety engineer, or inspector, is very effective for daily contact with these foremen.

Medical examination of applicants for employment is very important. The low percentage rejected, as shown in this paper, in spite of the stringent examination, indicates a very high physical standard of men applying for work.

The industrial accident arrangement of this project is distinctive and unusual because of the involvement of two states. The hospital and staff, first-aid stations and ambulance service have been well planned and function efficiently. The medical services offered are of the highest type, and the complete equipment at hand guarantee to the workmen the best of care in case of sickness or injury. After considering the many different types of work at Boulder Dam, it is readily seen that the medical staff must be ready for any kind of emergency twenty-four hours a day. The ambulance service and first-aid stations afford treatment and hospital care to those injured at the dam site within the shortest possible time. The cost of hospitalization to the workmen is very reasonable, and the benefits derived fully compensate each man for the small amount invested.

The records maintained on industrial accidents will be of interest when the entire project is complete. The medical-legal controversies will undoubtedly establish many points without precedence, due to the question of dual State control. It is practically impossible to complete such an undertaking without having to deal with persons who are always anxious to derive benefits at the expense of the company for some chronic condition or for an injury received other than in line of employment; and it is surprising to me that the officials have not been confronted with a great many more such cases than they have already experienced. Good medical examination and complete records at the time of employment are of outstanding value in keeping such cases at a minimum.

In summarizing this discussion, we find that a new community has been established with a very modern public health and emergency set-up. The city has grown to double the maximum population originally intended, and an enviable public health standard has been maintained. One of the largest construction projects ever undertaken is well under way, and thirty-six hundred employees and many of their families are cared for. The problems of housing, food, sanitation, industrial hygiene, safety, first-aid, and hospitalization have been exceptionally well met. Doctor Schofield and his assistants are to be congratulated for the splendid record they have established as public health officials and in industrial medicine.

TRAUMATIC EPITHELIAL CYSTS*

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TRAUMATIC epithelial cysts have been seldom mentioned in the American literature before the recent report by Wien and Caro.¹ For this reason, and in order to stress their relative frequency, it is deemed worth while to review the subject briefly, and to report the cases seen and studied by us.

CLINICAL FEATURES

The lesions are round or oval swellings the color of the surrounding skin. They may vary in size up to one or two or more centimeters in diameter. On palpation they are firm and usually freely movable over the deeper tissues and beneath the overlying skin, which may show evidence of previous injury in the form of a scar. They are

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